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NOTES ON THE GEOLOGY OF LOWER MERION AND VICINITY.

BY THEO. D. RAND.

Of much interest to those interested in mineralogy and geology in Philadelphia is the last volume, C^6, published by the Geological Survey, covering the geology of Philadelphia County, and of the southern parts of Montgomery and Bucks, by Chas. E. Hall, with a letter of transmittal by Prof. J. P. Lesley, but I think those acquainted with this region must regret that the publication was not delayed until the adjacent parts of Delaware County were examined, and until more time could be given to the work reported on, that it might be as near perfection as possible.

Mr. Hall's conclusions are at variance with all our preconceived opinions; but that is no reason for their rejection. If his data are correct, his conclusions seem almost necessarily to follow; but it is impossible for any one familiar with the district to examine the map and text without a feeling that longer study might have modified the author's views. All will agree with him as to the difficulties to be encountered; but this should have induced the greater care. In Mr. Hall's letter he states (p. xvii), "It has been my object to locate accurately the areas of the different belts of the metamorphosed rocks." And in Prof. Lesley's letter of transmittal (q. v), "Mr. Hall has not only studied every individual exposure at least once, and the more important ones repeatedly, but has obtained from them several thousand hand specimens."

If, as a test, we examine upon the map the serpentine outcrops, which are generally so easy of identification, we shall be disappointed. For instance, tracing the steatite belt westward from the soapstone quarries on the Schuylkill, the very distinct outcrop at the corner on Hagy's Ford road, at the road crossing, one mile from the Schuylkill, is wholly omitted. The outcrop on the Black Rock road is represented as extending of a width of about 200 feet for about 900 feet eastward of the old Gulf road, 1⅞ miles from the Schuylkill, while it is, at that point, over 1000 feet in breadth, and extends, though probably narrowing rapidly, fully 2000 feet eastwardly. West of this road, its location on the map is southward of its true position. This portion of the belt is made to end a short distance east of the Roberts road; whereas, on that road, it appears in place, with the garnetiferous schists bounding it on the north, a most distinct outcrop of over a hundred feet in width. Beyond this it is not shown until the Pennsylvània Railroad, at Bryn Mawr, is reached, where a very distinct outcrop 400 feet wide and 1500 feet long is delineated, just below the bridge at Penn Avenue.

The outcrop on the Roberts road can be followed by abundant fragments in the soil to a point where the southward course of the Black Rock road changes to W. S. W., just north of which a very distinct outcrop is visible in the side of the road.

I am quite familiar with the railroad cut at Bryn Mawr, which is through decomposed mica schists. I have searched in vain for the slightest evidence of steatitic or serpentine rocks in it. Recently the cut was widened. Taking advantage of the fresh exposure, I obtained specimens below Penn Avenue about every ten feet from 150 feet to 400 feet, including a light-colored stratum differing from the bright-colored decomposing schists elsewhere. All, without exception, were unmistakably decomposed mica schist with quartz. I believe, therefore, that serpentine and steatite do not there exist at or near the surface.

Examining the more northerly belt, that north of Lafayette Station, we find it represented as ending about 2000 feet west of the Schuylkill. There is, it is true, an apparent break in the belt at this point, and, as it were, a fault, throwing the westerly continuation southward; but the break is small, and the belt can be traced by abundant surface fragments to a point between 3000 and 4000 feet from the river, where another fault occurs (or a change of direction more northwestward) and an outcrop in place appears east of a road about a mile from the Schuylkill. Thence, on the map, the outcrop appears continuous; whereas, at the next road, where there is a gap through which a stream passes, there appears to be a fault, the westerly continuation of the belt being, as it were, shifted northwardly more than its width, showing on a small, but very distinct scale, the echelon structure so marked in the belt north of the syenite. The outcrop is represented as ending east of the old Gulf or Conshohocken road; whereas it can be traced by fragments, and one outcrop in place, to the new road to Bryn Mawr at the crossing of a branch of Mill Creek, on the lands of Yocum and Shalliol, where a large distinct outcrop in place occurs, whence it can be followed by surface fragments in a more southwesterly direction (S. 35° W.), than the easterly part of the belt, (S. 40° to 50° W.), probably 1000 feet. About 250 feet northward from this, and eastward of its ending, is another outcrop of serpentinous rock (another instance of echelon structure ?). About 1400 feet S. 60° W. is another outcrop, forming a distinct small hill not upon the map, and other minor outcrops further westward. The character of rock in the outcrops adjacent, north and south, above mentioned, is different in each. The southerly is talcose and chloritic, the northerly a hornblende-like rock altered into serpentine or some allied mineral.

The outcrop at Rosemont, Pennsylvania Railroad, from which much stone has been quarried, is not upon the map.

An outcrop of serpentine is delineated northeast of the crossing of the Gulf road and the Mattson's Ford road, or Township Line road, and (p. 3) located northwest of Mechanicsville.[1]

The rock at the point indicated on the map, which is within one-eighth of a mile southeast of Gulf Mills, and over one-half mile southwest of Mechanicsville, is altered hydromica schist. It bears a remarkable resemblance to the decomposed schists in the cut of the Pennsylvania Railroad at Bryn Mawr. There are outcrops of serpentine, one in place on the Gulf road, about 500 feet S. S. E. of the cross-roads ; the other, fragments in the soil, about 700 feet southeast. There is also an outcrop of similar serpentine, with steatite, on the Mattson's Ford road, just east of the Delaware County line. This is not upon the map. These outcrops, and another westward, were described in the Proceedings Acad. Nat. Sci., 1878, page 402, as belonging to a then undescribed northerly belt.

Mr. Hall (page 89) connects that on the Gulf road with the great belt passing through Radnor and through Chester County. He evidently has not examined the westerly outcrops.

The limestone in Upper Merion, just north of Gulf Mills (the south end of the Gulf), interesting in connection with that a mile farther up the Valley, is not upon the map, nor the eurite and the garnetiferous schists southeast.

Turning to the text, we find it stated (page ix) that " The serpentine belt of Bryn Mawr, instead of passing in a straight line southwest through Delaware and Chester Counties towards Maryland, swings around southward in a curve towards Chester, on the Delaware, not in an unbroken line, but in a series of projections, like the teeth on a circular saw, some of which reach Chester Creek."

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[1] On the map the name Mechanicsville appears to be given to the settlement at the south end of the Gulf, correctly Gulf Mills, which name it has borne for much over a century. Gulf Mills, on the map and in the text, is applied to McFarland's Mills at the north end of the Gulf. Mechanicsville is a small town, formerly known as Rebel Hill, in a gap over one-half mile south of the Gulf.

Without a map of these outcrops the precise meaning is not clear, but if a line be drawn upon the map,[1] connecting the Schuylkill soapstone quarries with the westernmost outcrop on the Black Rock road, and be produced southwestwardly to Chester Creek, the outcrop on Meadow Brook will be found three-quarters of a mile northwest of this line; that on Darby Creek, one mile northwest; that on the West Chester road, one-half mile northwest; that on the road from Newtown Square to Palmer's Mills, upon it, or very little northwest; that at Blue Hill, upon it; that on Dismal Run, thirteen miles from the Schuylkill, a quarter of a mile southeast; that at Lenni on Chester Creek, about a mile southeast.

If, in like manner, we produce a line passing through the Lafayette belt, from the Schuylkill to Rosemont, the Meadow Brook outcrop will be found upon it; that on Darby Creek, quarter of a mile northwest; West Chester road, less than a quarter of a mile southeast; Palmer's Mills, one mile southeast; Blue Hill, one mile southeast; Dismal Run, 1¼ miles southeast; Lenni, about two miles southeast.

Page 12, we find, "The primal * * * is not recognizable west of the Schuylkill river, south of the south edge of the auroral limestones of the valley in the South Valley Hill."

Page 32, "West of the Montgomery County line, near the southern margin of this group" (the South Valley Hill schists), "we find garnetiferous mica schists."

Page 36, "West of West Conshohocken the Potsdam does not exist, and the limestone rests directly upon the Laurentian;" but we find no mention of the sandstone and beds of sand, resulting from its decomposition, flanking the Chester Valley on the south, described by Prof. H. C. Lewis, in the Proceedings of the Mineralogical Section of the Acad. Nat. Sci., No. 1, page 93.

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[1] I have used map of Delaware County, by G. M. Hopkins & Co., of Philadelphia, 1876, which I believe to be the most accurate map of the County.

West of West Conshohocken, a rock wholly indistinguishable from the eurite of Barren Hill, which Mr. Hall considers proved to be Potsdam, *does* occur at several (at least three) localities, viz.: southeast of Mechanicsville, in Radnor just west of the county line, and at Wayne, P. R. R.

That the limestone rests directly upon the Laurentian is more than doubtful, for while they cannot be observed between the two adjacent outcrops near the river, yet if the lines of the two be prolonged, mica schists, garnetiferous mica schists, and the peculiar thin-bedded feldspathic gneiss with crystals of hornblende found south of the syenite between the serpentine and steatite, can be seen, having a breadth of probably over three hundred feet, within a thousand westward of the limestone exposure.

There are three facts tending to prove that Cream Valley on the south side of the South Valley Hill is, though very narrow, similar in structure to the Chester Valley :

I. The presence of limestone.
II. The existence of iron ores resembling those of the Potsdam.
III. The presence of eurite.

On page 27 the Manayunk mica schists and gneisses are stated to extend from the vicinity of Haddington on the south to Ardmore on the north.

There is no mention made of the porphyritic gneiss which begins eastwardly as a narrow belt at the Falls of Schuylkill, this rock by its superior hardness causing the " falls." It widens out westwardly until at the Pennsylvania Railroad it attains a width exceeding a mile, and occupies fully one-half the limits above quoted. It extends southward to Market Street; south of this I have not examined. It is too important a belt, not only in its extent, but also in its uniformity throughout its whole limits, to be ignored in a study of the region. The same may be said of the Frankford gneiss which appears to extend as a distinct and characteristic belt, but with a strike much more east and west than the other rocks, from Frankford to the Wissahickon.

That the syenite belt south of the South Valley Hill is an anticlinal seems beyond question. Now both on the north and south of it occur thin-bedded micaceous gneiss and hornblendic gneiss, succeeded by garnetiferous mica schist. In the syenite, or very close to it in the micaceous gneiss, both on the north and south occur beds of serpentine of almost identical appearance, and in the mica schists, steatite, talc and serpentine very similar in character on both sides of the anticlinal. So nearly vertical are all the dips that no very cogent argument can be derived from them.

North of the schists is eurite, almost undoubtedly Potsdam sandstone, then altered schists, limestone, trap, and then the South Valley Hill.

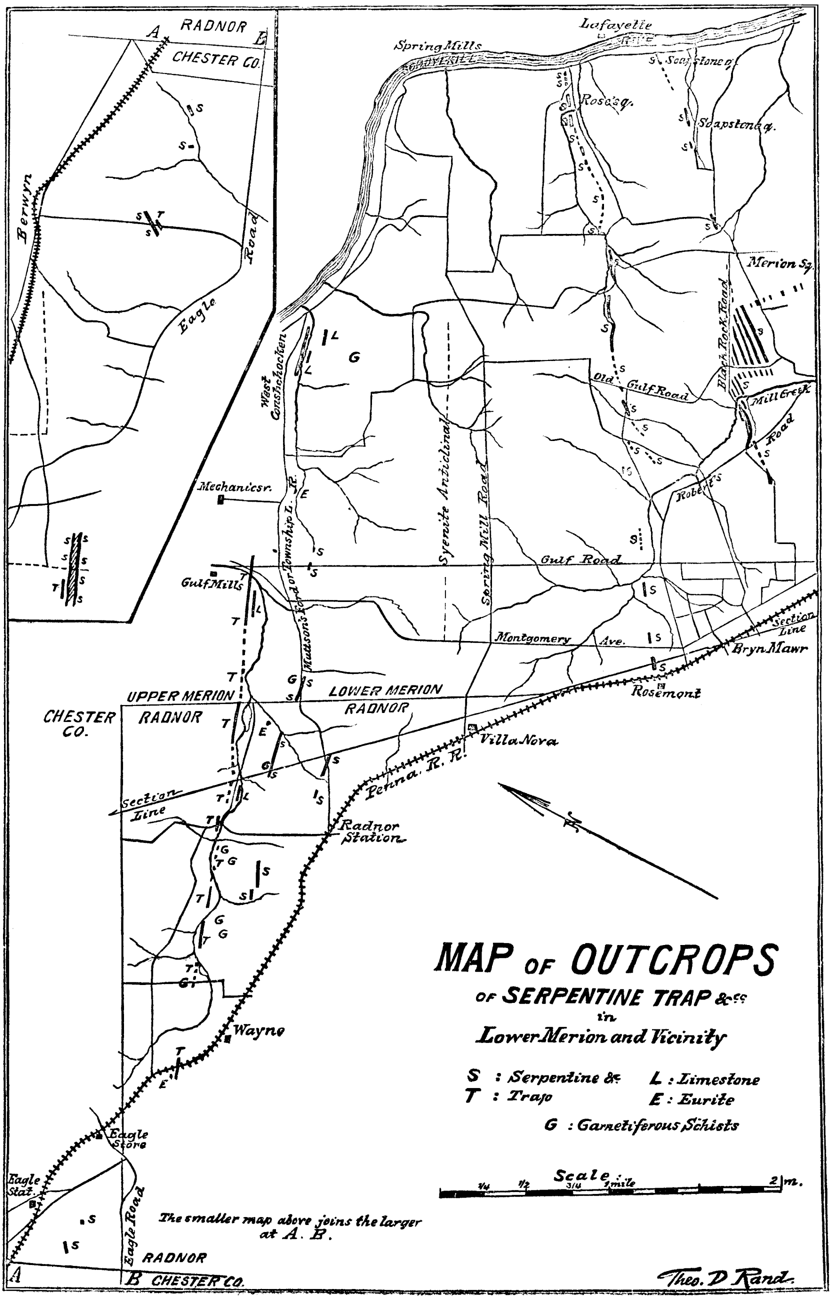
My view of a section along a line from Bryn Mawr northwest to a point in the north line of Radnor Township, Delaware County, about a half mile west of the east line, that is west of Mr. Hall's line H, and bearing a few degrees more northeast and southwest in order to connect one of the limestone outcrops in Cream Valley with the Rosemont serpentine outcrop, is given herewith. Outcrops of all the rocks are exposed within little over a half mile of this line, and all save the eurite, and the southern steatite belt, almost or quite upon it, though the characters of the rocks can in some cases be better studied in more distant outcrops, of undoubtedly identical rocks.

1. Syenite.

NORTHWARD.	SOUTHWARD.
	Thin bedded micaceous gneiss.
2. Serpentine.	2′. Serpentine.
3. Thin-bedded gneiss. Micaceous gneiss. Feldspathic gneiss with crystals of hornblende. Hornblendic gneiss.	3′. Mica schist and thin-bedded gneiss with crystals of hornblende. Hornblendic gneiss.
4. Steatite with serpentine.	4′. Steatite with serpentine.
5. Mica schists and garnetiferous mica schists.	5′. Garnetiferous mica schists.
Eurite.	
Schistose gneiss.	
Limestone.	
Schistose gneiss.	
Trap.	
South Valley Hill hydromica schists.	

Now if this succession occurs, if of 2 and 2′, 4 and 4′, each most closely resembles the other, and 3 and 3′, 5 and 5′, are not unlike, is it not strong evidence that the structure is a simple anticlinal?

I submit herewith a map of the region showing most of the outcrops mentioned.


MAP OF OUTCROPS
OF SERPENTINE TRAP &c.
in
Lower Merion and Vicinity
S : Serpentine &c.
L : Limestone
T : Trap
E : Eurite
G : Garnetiferous Schists
Scale : 1/4 1/2 3/4 1 mile 2 m.
The smaller map above joins the larger at A. B.
Theo. D Rand.
RADNOR
CHESTER CO.
Berwyn
Eagle Road
Lafayette
Spring Mills
Schuylkill
Soapstone q.
Rose's q.
Merion Sq.
Black Rock Road
Old Gulf Road
Mill Creek
Road
Roberts
West Conshohocken
Mechanicsv.
Syenite Anticlinal
Spring Mill Road
Gulf Road
Gulf Mills
Mattson's Ford or Township L. R.
Montgomery Ave.
Bryn Mawr
Section Line
Rosemont
UPPER MERION
LOWER MERION
RADNOR
CHESTER CO.
Villa Nova
Penna. R. R.
Radnor Station
Section Line
Wayne
Eagle Store
Eagle Stat.
Eagle Road
RADNOR
CHESTER CO.
A
B